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SKIMMER AND FILTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. Provisional Patent Application Serial No. 60/436,758 entitled,

5 "Method and Apparatus for Pond Skimmer and Filter," filed on December 27, 2002, and claims the benefit of the filing date thereof. The entire specification of the priority application is incorporated herein by reference.

BACKGROUND

10 Technical Field:

The present invention relates generally to the field of water treatment devices for the removal of debris from bodies of water, in particular, the invention relates to the field of filters, skimmers, and water treatment devices for ornamental bodies of water, such as pools, ponds, waterfalls and streams.

15 Background:

Skimmers and filters are often used in conjunction to clean and treat decorative bodies of water for landscaping, such as ponds and waterfalls. In general skimmers skim debris from the surface of the water and filters remove smaller debris from the entire depth of the water. Skimmers typically filter larger debris from the water surface with a coarse net or basket, while filters incorporate filter media, which can 20 be a variety of materials including but not limited to mats, rocks, and nylon mesh, all of which have limited capacity for water treatment. Often one or more pumps are used to draw the water to the mouth of the skimmer or filter. Once the water has been skimmed or filtered, it is returned from the skimmer or filter to the body of water.

Skimmers and filters are usually installed external to the body of water but in proximity to it. For 25 example, many skimmers and filters are installed in the ground adjacent the body of water. These devices are cumbersome and require careful installation to eliminate or reduce water loss during the transfer of water between the body of water and the water treatment device. Another difficulty with

filters, skimmers, and water treatment devices generally, is that the mouth, or weir, size is fixed, requiring the user to select a skimmer or filter of a particular size for a given application. Yet another difficulty with skimmers and filters is their inadequacy in reducing or eliminating living organisms, such as single-celled algae, protozoa, and bacteria.

5 An improved skimmer and filter device is needed that could be easily and efficiently installed, and provide superior water treatment.

SUMMARY

10 The skimmer and filter unit of the present invention is for use with a body of water. A tank portion of the unit defines an interior having a skimmer chamber, ultraviolet light chamber, filter chamber, and pump chamber. In addition to skimming and filtration, water received into the unit is subjected to ultraviolet light within the ultraviolet light chamber.

15 Objects, advantages and novel features, and further scope of applicability of the skimmer and filter will be set forth in part in the detailed description to follow, taken in conjunction with the accompanying drawings, and in part will become apparent to those skilled in the art upon examination of the following, or may be learned by practice. The objects and advantages of the skimmer and filter may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

20 BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated into and form a part of the specification, illustrate an embodiment of the skimmer and filter and, together with the description, serve to explain the principles of the skimmer and filter apparatus and method of operation. The drawings are not to be construed as limiting the skimmer and filter.

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Fig. 1 is a perspective, cutaway, exploded view of the skimmer and filter with a centrally located pump chamber removed, two ultraviolet light chambers and a single filter cartridge in the filter chamber;

Fig. 2 is a perspective, cutaway view of the skimmer and filter of Fig. 1 showing the partitioning walls;

Fig. 3 is a perspective, cutaway view of the skimmer and filter showing application of a single centrally located ultraviolet light chamber, two filter cartridges and a rear pump chamber;

5 Fig. 4 is a perspective, cutaway view of the skimmer and filter of Fig. 3 showing the weir door and a weir divider from the interior;

Fig. 5 is a top interior view of the skimmer and filter of Figs. 3 and 4 with the neck portion removed;

Fig. 6 is a perspective view of the skimmer basket of the skimmer chamber;

10 Fig. 7 is a perspective view of the skimmer and filter tank and a plurality of interchangeable weir faceplates;

Fig. 8 is a perspective, exploded view of the tank, lid, weir dividers, weir door, and weir faceplate of the skimmer and filter;

Fig. 9 is a rear perspective view of the weir faceplate;

15 Fig. 10a is a perspective exploded view of an ultraviolet light assembly and associated mount;

Fig. 10b is a perspective exploded view of the ultraviolet light assembly and associated mount of Fig. 10a as assembled into the skimmer and filter unit;

Fig. 11 is a perspective exploded view of filtration media for the filter chamber of the skimmer and filter;

20 Fig. 12a is a perspective view of the flow bypass valve in the closed position;

Fig. 12b is a perspective view of the flow bypass valve in the open position;

Fig. 13a is a perspective view of the interlocking lid of the skimmer and filter;

Fig. 13b is a perspective view of the tank and interlocking lid of the skimmer and filter;

Fig. 14 is a perspective view of a landscape application for the skimmer and filter;

25 Fig. 15a is a top view of the landscape application for skimmer and filter unit of Fig. 14;

Fig. 15b is a side view of Fig. 15a; and

Fig. 16 is a side view of a mid-water intake feature of the skimmer and filter.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The skimmer and filter unit of the present invention is depicted with two configurations of the various chambers; however, it will be understood by those of skill in the art that these and other 5 configurations of the skimmer and filter chambers are possible via the inventive principles.

Referring to Fig. 1, a perspective, cutaway, exploded view of skimmer and filter unit 10 is shown. Unit 10 includes a generally upright cylindrical tank portion 20 and interlocking lid 36. Unit 10 is in fluid communication with a body of water via a mechanically sealed skimmer faceplate assembly 12 and elongated neck 14. Neck 14 extends outward from a wall of tank portion 20, the distal end of which is 10 skimmer faceplate assembly 12. Skimmer faceplate assembly 12 provides a watertight connection to concrete, flexible membrane, or clay-lined bodies of water. Weir opening 17 defined in weir faceplate 16 receives water from a body of water. Neck 14 accommodates a plurality of interchangeable weir faceplates 16, each of which define an opening 17 of a different size. The selection of a weir faceplate 16 allows for the adjustment of the effective neck width, or weir width, to compensate for variable water 15 flow rates. Weir faceplate 16 is sealed to neck 14 with a series of fastening means 19, such as but not limited to screws, or nuts and bolts. Weir dividers 23 slide into mating slots of neck 14 to form the appropriate-sized fluid conduit that coincides with the dimensions of opening 17 of weir faceplate 16.

Within unit 10 are skimmer chamber 24, filtration chamber 28, one or more ultraviolet (UV) light chambers 26, and pump chamber 30, defined by the interior of tank portion 20, for the removal of debris, 20 various suspended and dissolved organic wastes, and living organisms, such as single-celled algae, protozoa, and bacteria. Tank portion 20 contains removable, semi-rigid skimmer basket 25 within skimmer chamber 24 to collect floating debris from the water after the water has passed through and over a pivoting and buoyant weir door 18 (see also Fig. 4). One or more UV light chambers 26 are positioned downstream of skimmer chamber 24.

25 Water flow, indicated with arrows, enters tank 20 through opening 17 over weir door 18, downward through skimmer chamber 24, then through one or more unidirectional ports located at the lower periphery of tank 20 through partitioning wall 31 to UV light chambers 26, which subject the water

to high-intensity UV light for purification and eradication of contaminants such as single-celled algae. After passing through UV light chambers **26**, the water continues through ports to filter chamber **28** for the mechanical removal of suspended solids and biological treatment for the removal of dissolved organic compounds. Filter chamber **28** can perform this function with one or more cartridge-based bio-
5 mechanical filter mats, or other suitable filtration means. After being drawn through filter chamber **28**, centrally located pump chamber **30** (pump not shown) pumps the water away from unit **10** back to the body of water.

Turning to Fig. 2, a perspective, cutaway view of skimmer and filter unit **10** of Fig. 1 reveals the partitioning walls between the chambers. Partitioning walls **32** separate UV light chambers **26** and filter 10 chamber **28**. Partitioning wall **31** separates skimmer chamber **24** from pump chamber **30**, filter chamber **28**, and UV chambers **26**.

Referring to Fig. 3, a perspective, cutaway view of skimmer and filter unit **10** shows application of a single central UV chamber **26**, two filter cartridges **29, 29'** and a rear pump chamber **30** (pump not shown). Pump chamber **30** houses submersible water pumps of various sizes and accommodates 15 fittings for attachment to an external pumping apparatus or drain fitting. Pump chamber **30** is vertically-accessible for efficient removal of the pumping apparatus without disturbance of the bio-mechanical filter media of filter chamber **28** or other filtration components. Fig. 4 is a perspective, cutaway view of skimmer and filter unit **10** of Fig. 3 showing weir door **18** and a weir divider **23** from the interior.

Fig. 5 provides a top view of skimmer and filter unit **10** of Figs. 3 and 4 with neck **14** removed.
20 Water enters over the weir door and travels downward through skimmer basket of skimmer chamber **24**. After passing through the skimmer basket, the water travels through unidirectional ports **13, 13'**, located in a lower portion of wall **31** near the bottom of tank **20**, into central UV chamber **26**. Water then travels from UV chamber **26** out of unidirectional ports **15, 15'** to filter chamber **28** where it passes through filter cartridges **29, 29'**. After passing through filter cartridges **29, 29'** the water is pulled into pump chamber 25 **30** where it is expelled back to the body of water by the pumping apparatus.

Turning to Fig. 6, a perspective view of skimmer basket **25** of skimmer chamber **24** is shown.

Skimmer basket **25** is removable by way of reaching into the interior of tank **20** and grasping handle **27**

affixed to basket 25 by an extended planar panel that places handle 27 conveniently within reach after removal of lid 36. (See also Fig. 2.) In this manner, skimmer basket 25 is readily removed, cleaned, and/or replaced from tank 20 as needed.

Referring to Fig. 7, a perspective view of tank 20 of skimmer and filter unit 10 and a plurality of 5 interchangeable weir faceplates 16 is shown. Each weir faceplate 16 defines an opening 17 of different dimensions to accommodate water flow. A pair of weir dividers 23 are used in conjunction with a particular weir faceplate 16 to guide water through neck 14 into skimmer chamber 24. (See also Fig. 8.) Weir dividers 23, 23', and 23" are shown positioned vertically in the appropriate mating slots of neck 14 behind skimmer faceplate assembly 12 to align with the width of openings 17, 17', and 17" respectively 10 of weir faceplates 16, 16', and 16". For example, weir faceplate 16" defining opening 17" would require weir divider 23" and its opposite weir divider (not shown) to be positioned in the innermost mating slots of neck 14 to align with the width dimension of opening 17".

Fig. 8 is a perspective, exploded view of tank 20, interlocking lid 36, weir dividers 23, weir door 18, and weir faceplate 16. Weir dividers 23 are frictionally fit into mating slots 35 of neck 14. Weir door 15 18 is frictionally fit into notches in lower corners of weir dividers 23 via mating hinge tabs at the lower corners of weir door 18, such that weir door 18 pivots in response to water pressure. Weir faceplate 16 is secured to neck 14 with fastening means 19 through mating openings 21 (see Fig. 9) in weir faceplate 16 and neck 14. In the event that the body of water is lined with a flexible membrane, or liner, the liner can be positioned between neck 14 and weir faceplate 16 and an incision made through the liner near 20 the top of skimmer opening 17 to allow water to pass into the skimmer. Preferably, the water level entering weir faceplate 16 is within 0.75 inches above or below water level mark 52 of faceplate 16 for optimal operation.

Referring to Fig. 9, a rear perspective view of weir faceplate 16 is shown. Flexible locking tab 22 is used to secure weir door 18 in a closed position when cleaning or performing maintenance on 25 skimmer and filter unit 10. To lock weir door 18 in a closed position to prevent fluid communication between unit 10 and a body of water, weir door is rotated upward and the top of weir door 18 is secured

behind catch 33 of locking tab 22. To release weir door, locking tab 22 is pressed upward and door 18 is released from its position behind catch 33.

In addition to the skimming and filtering features of the skimmer and filter unit 10, UV light is applied to the water for purification. Figs. 10a and 10b are perspective exploded views of a UV light 5 assembly 37 as assembled into tank 20 of skimmer and filter unit 10. UV mount 40 is affixed to the upper surface of UV chamber 26 defined within tank 20 with UV mount fastening means 39, such as but not limited to screws, or nuts and bolts. UV light 41 that is affixed to locking ring 38 is positioned through UV mount 40 and into UV chamber 26 so that UV light 41 is fully inserted into UV chamber 26. Tabs on locking ring 38 are inserted into mating slots in UV mount 40. Once inserted, locking ring 38 is rotated 10 approximately 1/4 of a turn to secure UV light assembly 37 into UV light chamber 26. A power source, such as one or more batteries, or electrical connection to a power outlet is used to power UV lights 41.

Ultraviolet light purifies the water and eradicates contaminants. A baffle block can be used to prevent water flow to an unused UV chamber 26. For example, water bodies less than approximately 5000 gallons may require operation of only one UV chamber for sufficient purification. Table 1 provides 15 examples of UV lighting power and approximate gallons per hour (GPH) of water flow required through the UV light chamber for sufficient water treatment:

Table 1

Number of 25 Watt UV Lights	Number of 37 Watt UV Lights	GPH (min – max)
1	0	500 – 2500
0	1	500 – 4000
1	0	1200 – 2500
0	1	1200 – 4000
2	0	1200 – 5000
2	0	2500 – 5000
0	2	2500 – 8000

When beneficial bacteria is introduced to a body of water, power is preferably removed from the UV light for approximately 24 hours to allow the bacteria to settle.

Water is filtered within filter chamber **28** after the water has been treated with UV light in UV chambers **26**. Fig. 11 provides a perspective exploded view of filtration media for filter chamber **28**.

5 Filtering can be achieved, for example, with a bio-mechanical filter mat **42**, or other suitable filtration means, secured within a housing or cartridge **43** that is placed within filter chamber **28**.

After the water passes through filter chamber **28**, it enters pump chamber **30** where a pump pumps the water away from the skimmer and filter unit **10** back to the body of water. Occasionally, filter mats **42** become clogged with debris, which can prevent a sufficient flow of water to the pump. To 10 prevent this from occurring, float-actuated bypass valve **34** is integrated into partitioning wall **31** (see Fig. 3) between skimmer chamber **24** and pump chamber **30** to monitor the level of water within pump chamber **30** and allow additional water to flow into pump chamber **30** from skimmer chamber **24** should the water level be insufficient.

Referring in combination to Figs. 12a and 12b, perspective views of bypass valve **34** in the closed 15 and open positions are shown respectively. When the water level in pump chamber **30** is sufficiently high, valve **34** floats to the upper position and is stopped by stop **44'** affixed to partitioning wall **31**. At this point valve **34** blocks the flow of water through opening **45** defined in wall **31**. Should the water level in pump chamber **30** drop, valve **34** drops, until stopped by stop **44** affixed to partitioning wall **31**, and unblocks opening **45** defined in wall **31** thereby allowing the flow of water from skimmer chamber **24** into 20 pump chamber **30**.

Skimmer and filter unit **10** is protected from the environment by tank **20** and interlocking lid **36**. Turning to Figs. 13a and 13b, interlocking lid **36** and interlocking lid **36** affixed to tank **20** of skimmer and filter unit **10** are shown respectively. Lid **36** interlocks to tank **20** by stabilizing flange **48**, which extends around the periphery and orthogonally downward from the bottom planar surface of lid **36**, mirrors the 25 shape of, and mates with the interior upper surface of tank **20** (see also Fig. 8). Fastening means **46**, such as but not limited to screws or nuts and bolts, are positioned through mating openings **47** defined in lid **36** and tank **20** to secure lid **36** to tank **20**. Interlocking lid **36** having stabilizing flange **48** prevents

deformation of skimmer and filter unit **10** particularly when installed in subterranean environments. The exterior surface of lid **36** is coarse for increased frictional contact with external surroundings.

Turning to Fig. 14, a perspective view of a landscape application for skimmer and filter unit **10** is shown. If the landscape application includes waterfall, skimmer and filter unit **10** is positioned opposite the waterfall at an end of a body of water for improved skimming and filtering operation. Preferably skimmer and filter unit **10** is positioned below ground level approximately six inches away from the coping shelf.

Fig. 15a provides a top view of the landscape application for skimmer and filter unit **10** and Fig. 15b provides a side view for the landscape application of Fig. 14. Preferably skimmer and filter unit **10** is positioned so that the bottom surface of tank **20** is approximately nineteen inches below the intended water level and the bottom surface of neck **14** is approximately seven inches below the intended water level, leaving approximately three to five inches between the water level and the ground level surface created by backfilling around skimmer and filter unit **10**.

Referring to Fig. 16, a side view of an optional mid-water intake to skimmer and filter unit **10** is shown. A mid-water intake aids in preventing wear on the pump if the water level falls below the level of the weir of skimmer faceplate assembly **12**. Further, in cold-weather applications when ice forms at the water surface, weir door **18** (see Fig. 8 and 9) can be closed via locking tab **22** and water can be drawn from beneath the surface of the ice through the mid-water intake directly into skimmer chamber **24**.

Although the skimmer and filter has been described in detail with reference to these embodiments, other embodiments can achieve the same results. Variations and modifications of the skimmer and filter will be obvious to those skilled in the art and the appended claims are intended to cover all such modifications and equivalents.